

Asthma Onset and Exacerbation in Children Exposed to Traffic-Related Air Pollution

April 23, 2009



California Air Resources Board

California Environmental Protection Agency

Thank you Mr. Goldstene. Good morning, Chairman Nichols and members of the Board. In today's health update we will be presenting the findings of a recently published study on the association between onset of childhood asthma and traffic-related air pollution exposure in Southern California communities.

Impacts of Air Pollution on Asthma

- Asthma – leading cause of chronic illness
 - 16% of California children are asthmatics
 - \$500 million annual cost for asthma treatment
- Air pollution can worsen asthma
 - 280,000 asthma exacerbation and lower respiratory symptoms
 - Traffic pollutant exposure associated with asthma

Asthma is the leading cause of chronic disease in U.S children, according to the Center of Disease Control's National Health Interview Surveys. During an asthma attack, the airway constricts, swells, and becomes congested. This leads to tightness in the chest, wheezing and difficulty in breathing. In severe cases, asthma attacks can be deadly. In 2005, an estimated 16% or 1.5 million children in California had been diagnosed with asthma at some point in their lives. The prevalence is rising-four years earlier it was 14 percent. As a comparison, the rate of attention-deficit/hyperactivity disorder is approximately 6% in U.S children and the rate of childhood diabetes is only 0.2% in the U.S. The cost of treating children with asthma in California is estimated to be around 500 million dollars per year. Air pollution plays a well-documented role in asthma. An estimated 280,000 episodes of asthma and lower respiratory symptoms results from fine particulate matter exposure in children 7-14 years of ages in California each year. A growing body of evidence indicates that traffic-related pollutant exposure can increase the risk for asthma and worsening of asthma symptoms.

Note: Based on 2004-2006 PM2.5 concentrations above 5 $\mu\text{g}/\text{m}^3$

ADHD: Perrin et al 2007 The Increase of Childhood Chronic Conditions in the United States. American Medical Association, June 2007 vol 297 No24

Diabetes: (Type I and II) National Diabetes Statistics ,2007

Asthma; CDC, National Health Interview Survey.

Air Pollution and Asthma Onset

- Can ambient air pollution be linked to asthma onset (newly-diagnosed cases of asthma)?

So a question that remains is: can ambient air pollution be linked to asthma onset ? That is, does air pollution only worsen symptoms in children with existing asthma or can it be linked to new cases of asthma? This is the topic of our health update today.

Southern California Children's Health Study

- 10+ year study followed 6,000 children's chronic exposures to air pollution
 - Community monitoring ($PM_{2.5}$, PM_{10} , constituents of PM, O_3 , NO_2 and acid vapor)
- Landmark study on children's health effects
- Adverse effects on lung function growth, asthma, school attendance
- 100+ publications



<http://www.arb.ca.gov/research/chs/chs.htm>

The findings I am going to discuss today are the latest to come from the Southern California Children's Health Study, the longest US investigation into air pollution and children's health. Originally funded by ARB, this study has tracked children's respiratory health since 1993 and is currently being funded by the National Institute of Environmental Health Sciences. The study looked at the air pollution impacts on 6,000 children recruited from 12 southern California communities chosen for their differing pollution profiles. $PM_{2.5}$, PM_{10} , constituents of PM, ozone, NO_2 and acid vapor were measured in each community during the study period. Measurements from these children included annual lung function tests and the administration of questionnaires. Several ground-breaking results and over 100 peer-reviewed articles have emerged from this study.

Note: PM constituents- sulfate, nitrate, elemental and organic carbon, ammonium, metal and ions (Na, Mg, Al, Si, P, S, Cl, K, Ca, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, As, Se, Br, Rb, Sr, Y, Zr, Mo, Pd, Ag, Cd)

Asthma Onset and Traffic Pollution

Methods

- 217 children from 11 communities in the Southern California Children's Health Study
- New asthma cases reported annually through questionnaire during the 8-year follow-up
- NO₂ monitored as a marker for traffic



Jerrett et al. 2008. Traffic-Related Air Pollution and Asthma Onset in Children: A Prospective Cohort Study with Individual Exposure Measurement. *Environ Health Perspect* 116:1433-1438. Funded by CARB, NIEHS, US EPA and the Hastings Foundation.

The study we are presenting today involved a subset of 217 children, 10-18 years of age with no doctor diagnosed asthma at the beginning of the study, living in 11 communities from the Children's Health Study. New asthma cases were reported annually through questionnaires during the 8 year follow-up of the children. NO₂ monitors were placed outside the homes of the children as a marker of traffic for two weeks in the summer and two weeks in the winter season.

Asthma Onset and Traffic Pollution

Results

- Asthma onset was positively associated with traffic pollution
- About 30% higher risk of asthma onset was seen in communities with higher NO₂ exposure
- Study limitations
 - Limited monitoring data at homes
 - Relatively small sample size
 - Asthma cases by questionnaire



The study found that asthma onset was positively associated with traffic pollution. An approximately 30% higher risk of asthma onset was seen in children living in communities with higher NO₂ exposure. The study was limited by the fact that NO₂ was monitored at the homes of the children for only two weeks per season. Other limitations include the lack of monitoring data for other pollutants at children's homes, the relatively small number of subjects and the use of questionnaire rather than direct verification of new asthma cases.

Asthma Onset and Prevalence

Other Children's Health Study Results

- Asthma onset found in children highly exposed to ozone (1)
- Increased prevalence (children already diagnosed with asthma) in children exposed to traffic-related pollution (2,3)

1. McConnell R et al. 2002, Asthma in exercising children exposed to ozone: a cohort study. *Lancet* 359:386-91
2. Gauderman WJ et al. 2005. Childhood asthma and exposure to traffic and nitrogen dioxide. *Epidemiology*, 16:737-743
3. McConnell R. et al. 2006. Traffic, susceptibility and childhood asthma. *Environ Health Perspect* 114:766-772

Additional evidence for the link between air pollution exposure and asthma onset comes from an earlier report from the Children's Health Study. In that report, researchers found new diagnoses of asthma in exercising children in communities with high ozone concentrations. Also, two other reports from the Children's Health Study found increased prevalence (that is, children already diagnosed with asthma) in children living near higher traffic roads and freeways.

Conclusion

- Traffic-related pollutants (NO₂ and ozone) linked to onset of asthma
- Reducing traffic exposure in children is expected to reduce asthma symptoms and asthma prevalence



In conclusion, evidence is beginning to emerge that exposure to traffic-related pollutants may influence asthma onset. Although NO₂ was the monitored pollutant in this study, NO₂ may only be a marker for some other component of traffic pollution that is associated with traffic impacts on asthma. Identifying the actual components of traffic pollution responsible for the health impacts observed is, in fact, the subject of intense study. However, continued reduction of traffic exposure in children is expected to reduce asthma symptoms and asthma prevalence in this susceptible population.

This concludes the Health Update; we will be happy to answer any questions. Thank you.